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THE BEDBUG

Its Relation to Public Health, Its Habits and Life History, and Methods of Control

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THE BEDBUG

Its Relation to Public Health, its Habits and Life History, and Methods of Control[1]

The bedbug is one of the numerous insects which convey disease to man. While it does not have the known importance as a disease carrier that mosquitoes, lice, and fleas have, its role is sufficiently important, according to Brumpt,[2] to necessitate the occasional consideration of the bedbug in our program of disease control. Brumpt cites the following evidence on this point:

Under special conditions, the bedbug acts as a carrier of the cosmopolitan recurrent fever caused by *Spirochaeta recurrentis*. Although its role in this connection is secondary to that of lice, various writers have reported that in epidemics of typhus, associated, as they commonly are, with recurrent fever, successful delousing procedures have been followed by the prompt clearing up of typhus cases, with the persistence of recurrent fever, and the disappearance of the latter only after a campaign for bedbug eradication. The spirochete has been found to live, with its virulence undiminished, for over a month in the digestive tract of the bedbug, and for over 2 months in the body cavity of the bug.

Similarly, the bedbug has a minor role in the transmission of plague, the major role being that of the flea. It has been found that plague bacilli can survive for approximately 5 months in the bedbug, multiplying and maintaining their virulence, and capable of producing plague when the excreta of the bug are rubbed on the skin. This mode of infection is probably rare, but is something to be kept in mind as a possibility.

In addition to the above, it has been found that powdered material from bedbugs taken from the beds of patients suffering from an unidentified form of exanthematous typhus, would produce in guinea pigs a disease identical with that produced in them by injecting the blood of human patients. Also, bedbugs will carry, for some time, the virus of *Rickettsia mooseri*. The virus of yellow fever will be present for several days in the excreta of bedbugs fed on a case of yellow fever during the febrile stage, and powdered material, prepared from such bugs, will transmit the disease for 2 to 12 days after the feeding. Apparently bedbugs may have a secondary role of some importance in epidemics of yellow fever. Bedbugs have not been found capable of

[1] Revision of Reprint No. 626.

[2] Précis de Parasitologie, v. 2. Paris.

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transmitting anthrax by their bites, but anthrax bacilli of high virulence may survive in the bodies of the bugs for as much as 5 months. Leishmania will undergo some development in bedbugs, but they have not been convicted of transmitting leishmaniasis in tests made up to this time. Bedbugs have been shown to transmit *Trypanosoma cruzi*, the organism of Chagas' disease, an American trypanosomiasis of man, by means of their excreta, this being the usual mode of transmission of this disease by its customary vectors, species of *Triatoma*. The spirochete of the epidemic icterogenic spirochetosis of Brazzaville can be transmitted by the bedbug from an infected animal to a susceptible animal for a period of 38 days after feeding on an infected animal. Bedbugs have been found capable, in experiments on guinea pigs, of transmitting, in attenuated and mild form, infections with hemolytic streptococci, and to harbor the staphylococci in the salivary glands as long as 15 days. Bedbugs fed on a rabbit at the place of application of smallpox vaccine were fed on another rabbit 12 days later, with the production of typical smallpox vesicles at the site of feeding.

In view of the above, including the fact that under insanitary and crowded conditions the bedbug might transmit septicemic diseases, the extermination of bedbugs as a routine part of any program of sanitation or disease control appears to be warranted. In addition, the bug is a highly offensive and esthetically objectionable pest. Many individuals are so susceptible to its bites and to its offensive odor that it is impossible for them to sleep in a room in which bedbugs are present. From either a medical or esthetic point of view, every effort should be made to keep all dwellings, hospitals, ships, and other premises free from these disgusting insects.

The following information is abstracted, in rearranged form and with slight modifications, from Farmers' Bulletin 754,[3] revised edition of April 1935, by Dr. C. L. Marlatt, former Chief of the Bureau of Entomology, United States Department of Agriculture.

ORIGIN AND DISTRIBUTION

The bedbug is an ancient pest of the human race, and its scientific name, *Cimex*, is the common name under which the Romans knew it. A wide variety of common names have been applied to it in various countries. It was once known in England as the wall louse, and later as the chinch. In the United States, its common names are often more or less facetious, and these names include chinches, chintzes, mahogany flats, red coats, and crimson ramblers.

Its presence in a household is not necessarily indicative of neglect or carelessness, since it may be introduced in spite of all reasonable precautions. It may enter in the baggage of guests, or in baskets of laundry. It may migrate from adjoining houses or apartments,

[3] Farmers' Bulletin 754. The Bedbug.

especially when the occupants of such houses or apartments vacate them and the bugs are compelled to seek new sources of food.

VARIETIES AND RELATED INSECTS

Various species of the human bedbug have been described, but these may prove to be merely variations of the ordinary bedbug and not true species. A number of parasitic bugs, more or less closely related to the true bedbug, attack birds, including poultry, and bats in various parts of the world, living on these hosts and in their nests and roosting places. One of these, *Haematosiphon inodora*, a pest prevalent in the southwestern United States and in Mexico, was probably a parasite of birds and bats originally, and has now become a serious pest of poultry, and often a serious pest in the house, sometimes more so than the true bedbug. The barn swallow bug, *Oeciacus hirundinis*, sometimes leaves the nests made by the swallows under the eaves of houses and becomes a pest in the house, infesting the beds and causing much annoyance. Another species, *Cimex hemipterus*, normally a parasite of birds and bats in the Old World, but present also in Brazil, and the West Indies, sometimes becomes a parasite of man.

GENERAL CHARACTERISTICS

The bedbug belongs to the Hemiptera, a group of true bugs having a piercing and sucking beak. Some of its relatives feed on plant juices in the same way that the bedbug feeds on blood. Like most of the insects feeding on man and closely associated with man and his dwellings, the bedbug is wingless, probably having lost the wings, structures still present in many of its relatives, because of its parasitic habits.

The adult bug, before feeding, is a flattened, oval insect, rust red, and with the abdomen more or less tinged with black. When engorged with blood, the body becomes bloated and elongated, and takes on a bright red color from ingested blood. The wings are represented only by barely recognizable pads. The compound eyes are present but the simple eyes or ocelli, present in most true bugs, are lacking.

THE BEDBUG ODOR

The bedbug has a well-known, distinct, and very disagreeable odor, a characteristic which it shares with some of its relatives that feed on plants. The odor is produced by a clear, oily, volatile liquid secreted by glands in various parts of the bug's body.

HABITS AND LIFE HISTORY

The bedbug is normally nocturnal, but under the impulse of hunger it will attack persons in daylight and in well-lighted rooms. Ordinarily it remains in concealment in cracks, bedding, or other places by day

and while lights are burning, emerging in the dark to feed and again returning to its place of concealment. Wooden bedsteads, wainscoting, mattresses, loose wall paper, and similar places are the favored hiding places.

The bedbug undergoes an incomplete metamorphosis, the young larval bug resembling the adult in form, structure, and habit, in contrast to such insects as flies and moths which undergo a complete metamorphosis, or change of form, from the larva through the pupa or chrysalis to the winged adult. The changes in the bedbug, externally, are mostly a matter of increase in size.

The eggs are white oval objects. Around one end is a lidlike top having a projecting rim. These eggs may be found in batches of 6 to 50 in places where the adults hide. The female bug may deposit from 1 to 5 eggs, or more, almost daily for a period of 2 months or more, a total of as many as 190 eggs.

The eggs hatch in a week to 10 days in hot weather, but may take twice as long to hatch in cold weather, and low temperatures may entirely stop development. When hatching, the young insect in the shell pushes up the "lid" at one end of the egg, emerging as a yellowish-white, almost transparent, insect. In its development from the larva to the adult, the bedbug normally molts five times, the wing pads being present after the last molt to the adult. The length of time necessary for completing this development is very variable, depending on temperature and food supply. Under favorable conditions there is a period of about a week between egg laying and hatching, and between successive molts, making the total period between egg laying and maturity about 7 weeks. The period of molting is shorter in the earlier stages, and lengthens in the later stages, but there are many exceptions and individual variations in development. When kept without food, the bug may remain unchanged in any of the immature stages for an indefinite time, and checking development by starvation may result in additional molting periods.

Ordinarily, only one meal is taken between molts, so that each bug feeds on a host five times before maturity and at least once afterward before it can develop eggs. It may feed oftener between molts, especially if disturbed before completing a feeding. It requires from 5 to 10 minutes to become engorged with blood. After feeding, it retires to its hiding place for 6 to 10 days to digest the meal and to molt, in the case of the larva, or begin the function of reproduction in the case of the adult. Under favorable conditions, these processes are carried out throughout the year, and at least four successive broods may develop in a year in houses kept well heated in winter.

FOOD AND LONGEVITY

Normally, the bedbug feeds only on human beings, but it can be forced to feed on mice, rats, birds, etc., and probably may do so in nature in the absence of human hosts. The presence of the bug in long untenanted houses may occasionally be accounted for in this way, but is probably due, as a rule, to its ability to survive for approximately a year, perhaps longer, without food. Temperatures which check activity may increase longevity. The idea that the bug can subsist on dust or similar things is an explanation for longevity which seems to have no foundation in fact. A similar idea, once prevalent in the West, to the effect that the bug could live for long periods on dead or diseased cottonwood logs, is due to the confusion of the bedbug with another insect, *Aradus* sp., which somewhat resembles a bedbug.

INFLUENCE OF TEMPERATURE

The bedbug may be a troublesome pest in the far North, since it lives in heated dwellings which protect it from extreme cold. It is more prevalent in the north temperate latitudes than farther south, partly because it is sensitive to high temperatures, large numbers of the bugs being killed by temperatures of 96° to 100° F. or more, when accompanied by fairly high degrees of humidity. Mature or partly mature bedbugs can survive temperatures below freezing for a considerable period. The eggs and newly hatched larvae succumb to temperatures below freezing maintained for 15 days to a month. Feeding and developing practically cease at 50° F., the insect remaining quiescent and in semihibernation at this temperature, so there is some protection in winter from sleeping in cold bedrooms. The most favorable temperatures for activity are between 60° and 98° F.

THE BITE OF THE BEDBUG

The bite is decidedly poisonous to some individuals, producing a slight swelling, usually about 2 mm in diameter, and a disagreeable inflammation with erythema over an area 15 mm in diameter. Some persons are less sensitive to the bite, and may never recognize the presence of bedbugs except as they find evidence in the form of linen stained by a crushed bug. The inflammation is largely due to mechanical puncture. There are no secretions other than the natural fluids of the mouth. Ota has found that a water extract of the bug is very toxic for the frog. The possibility of an allergic reaction to the mouth fluids or other secretions might be considered in the cases of individuals manifesting severe reactions to the bite.

The biting organ consists of the heavy, fleshy underlip which is the only part ordinarily seen on superficial examination, and 4 setae or threadlike hard filaments lying concealed within the lip. These setae glide over one another with an alternating motion when piercing the flesh, causing the blood to flow more freely, and the blood is drawn up through the beak, which is closely appressed to the skin puncture.

The irritation caused by the bite may be allayed, to some extent, by the use of peroxide of hydrogen. Tincture of iodine, either at ordinary or double strength, may also be used, but must be used with caution on the skin of infants or persons suffering with or disposed to eczemic disorders. Vinegar or aromatic spirits are useful in allaying the itching.

NATURAL ENEMIES OF THE BEDBUG

Bedbugs are occasionally attacked and destroyed by the house centipede, *Scutigera forceps*, and by the common little red house ant, *Monomorium pharaonis*, the latter being especially effective, but in general the control effected by these means is unsatisfactory, and neither the centipede nor the ant is usually welcome in the house. Remedies of general value must be more dependable and specific.

CONTROL OF BEDBUGS

The most effective method for control of bedbugs is fumigation with hydrocyanic-acid gas. This gas is very penetrating and very effective. It is, at the same time, very deadly and very dangerous to man and other animals, and should be employed only by competent persons, preferably by trained experts.[4]

Fumigation by means of burning sulphur is also very effective. It has the disadvantage that sulphur fumes will bleach fabrics, furnishings, and wall paper, especially in the presence of moisture, and should be used when the house is thoroughly dried out by a heating system. The fumes will attack metal surfaces also, and all objects subject to such attack should be removed or coated with vaseline. Finally, burning sulphur must be handled with every precaution against starting a fire, the burner being placed within a larger fire-proof container that cannot be upset readily, and from which burning sulphur cannot overflow. Two pounds of sulphur are recommended for each 2,000 cubic feet of space, and the building should be closed during fumigation for at least 5 to 6 hours, or preferably for 24 hours. After fumigation it should be thoroughly aired.

Such gases as formalin and the vapors of benzine, naphthaline, and camphor are of little value. Insect powders have limited value, largely

[4] Farmers' Bulletin 1670. Hydrocyanic-acid gas as a fumigant for destroying household insects. U. S. Department of Agriculture.

because of the difficulty of getting them into all of the places in which the bug conceals itself.

A kerosene extract of pyrethrum, or just kerosene or benzene, may be used to advantage, especially if only one room is infested. Many of the fly sprays on the market are kerosene extracts of pyrethrum, and these may be used. The liquid should be applied by means of a small hand sprayer, directing it at close range into all cracks, crevices, and open spaces, behind loose wall paper, and around baseboards and picture moldings, on mattresses, etc. The spraying should be repeated 10 days later, regardless of whether bugs are seen or not, and this usually ensures their eradication. However, frequent examinations for bugs should be made, and the spraying repeated as often as necessary if any are found.

Since the bugs may be killed by sufficiently high or low temperatures, it is sometimes possible to use heat or cold for control. In summer houses in the North, left untenanted during the winter, temperatures below freezing over a period of 15 days to a month will destroy the eggs and young bugs, and over a considerable period will destroy most, if not all, of the adult bugs. High temperatures are even more effective, and at a temperature of 113° F. the eggs and young are soon killed. During the summer, when the outside temperature is high, the heating system may be used to bring the interior temperature of the house up to 120° to 130° F., or higher, and in tests this method appears to kill all bedbugs, and also fleas, cockroaches, and other insects. This has been done without damage to the house or its contents, but apparently it would be advisable to remove musical instruments and similar things which might be damaged by exposure to these temperatures.

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